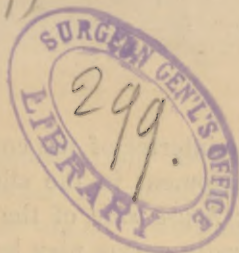


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WHY SEWER TRAPS ARE UNRELIABLE, AND HOW
TO APPLY THE OUNCE OF PREVENTION
AGAINST DISEASE GERMS IN
SEWER AIR.

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The practical bearings of this paper upon the life and health of 50,000,000 of human beings exposed here and in Europe to emanations from sewage are, it seems to me, so vitally important that I propose to commence by giving its salient points so closely condensed that they may be glanced over by the busiest reader. In the following pages, then, I assert,—

1st. That, according to the germ theory of disease in the form for which during the past fifteen years I have been an earnest advocate, * diphtheria, typhoid fever, scarlet fever, and probably other contagious diseases, are connected with, if not solely due to, the development of spores or germs of vegetable organisms in the human body.

2d. That these germs propagate in sewers and float to us on the sewer air, penetrating into our dwellings through water closets, sinks, stationary wash-stands, etc.

3d. I have just discovered that the reason our various ingenious traps fail to protect us against these fatal sewer diseases is that sometimes a layer of micrococcus and mycelium creeps along

* See Experiments showing the occurrence of Vegetable Organisms in Human Blood.—Amer. Jour. of Med. Sciences, July, 1868, p. 291. Handbook of Medical Microscopy, Philadelphia, 1871, pp. 196, 252. The Germ Theory of Disease and its present bearing on Public and Personal Hygiene.—Penn. Monthly, Nov. 1878, p. 858.

the interior of the contrivance until it forms a new depot of development in the slimy vegetable lining extended into the *inner* or *house side* of the trap, from which, without obstruction, its deadly germs may be given off into the very bed-chambers of its victims; therefore,

4th. The true method of obviating this danger is by sterilizing with slow currents or drippings of solutions of Sulphate of Iron, Corrosive Sublimate, Arsenic, Carbolic Acid, etc., the whole interior of our waste pipes, just as the shores of the Dead Sea and the banks of certain small streams are sterilized by mineral ingredients, or poisonous metallic substances from manufacturing refuse, with which their waters are mingled.

The first proposition above enunciated needs no defence with believers in "organic entities" as causes of disease, and to the conservative majority of our profession who still doubt the germ theory, I would urge that sanitary precaution in accordance with its doctrines is now an imperative duty, since this hypothesis has been accepted by such a respectable minority of physicians, including a large proportion of those whose special studies of medical microscopy have best qualified them to judge its merits. Only a duty, I admit, however, as yet, *provided* these precautions do not themselves involve danger to health; do not interfere with other safeguards dictated by rival theories of disease; and are not so troublesome as to be practically inapplicable.

I cannot claim in support of my second proposition that I have ever yet propagated any of the disease poisons in a sewer, and yet the innumerable culture experiments of Koch, Klein, Pasteur, H. C. Wood, and a host of their disciples, have so conclusively shown that the conditions of algoid growth are warmth, air, moisture, and nitrogenous matter, that I think there can be no reasonable doubt that propagation of disease germs does frequently occur in sewers, where it is incontestable that these necessary physical conditions are *all* abundantly present. I have determined by direct observations upon the gelatinous films of vegetable growth lining waste-pipes communicating with sewers, the presence of micrococcus, bacteria, and mycelium, morphologically identical with those of diphtheria, and of Klein's pig-typoid fever; and since the condition of existence for the

common forms of these low vegetable organisms and for the disease germs are known to be similar, it becomes, I think, certain that in situations where I found abundant algoid spores and mycelium, the disease germs of diphtheria, typhoid fever, etc., could have propagated themselves had they happened to find a lodgment. Lastly, as direct evidence from the clinical side of the question, we have such suggestive records as the following "stubborn facts": Dr. Wm. N. Thursfield, of Birmingham, England, reports tracing an isolated case of diphtheria to temporary exposure to "sewer gas" in a house on a short line of sewer which he *knew* to be specifically contaminated by diphtheria. This sewer, when opened and examined by a surveyor, produced in him a severe diptheritic attack (*London Lancet*, August, 1878, p. 211). Dr. Wm. V. Keating details at length four cases of typhoid fever attributed to sewer gas from untrapped drain pipes, and refers (on page 117) to cases of measles, scarlet fever, and diphtheria in two other families apparently from the same cause (Trans. of College of Physicians of Philadelphia, 1879, p. 85). Dr. C. W. Chamberlin, of Hartford, relates a remarkable case of fatal erysipelas seemingly due to sewer gas from a waste pipe carelessly left open beneath the bed of the patient (Connecticut State Board of Health Report for 1880, p. 5). Dr. Geo. Wilson quotes the account of 20 out of 22 boys of Clapham, England, in 1829, who were attacked with violent vomiting, purging, and fever within three hours after standing over a choked-up drain, watching the workmen clean it out (Wilson's Hand-book of Hygiene, 3d American edition, p. 68). Nor are these isolated instances, for the medical journals of America and Europe record numerous similar examples of dangerous or fatal effects from disease poisons in sewer air when inhaled by human beings.

The most important fact mentioned in my third statement was discovered in a purely accidental manner, as follows:—

On moving into a new residence I had all the stationary wash-stands fitted with ball-traps of the most approved construction. Noticing, however, after a few months, that the flow of waste water through one of them seemed to be impeded, I unscrewed the glass cup which forms the lower segment of the trap for the

purpose of removing the obstruction, and was surprised to find what appeared to be a fragment of thick black blotting paper hanging from the vertical pipe. On further investigation I discovered that this was part of a continuous lining to the upright tube of the trap, which lining extended a little above the ordinary water level on the inner or house side, and in order to determine its nature I detached a portion for microscopical examination. At first I did not appreciate the tremendous importance of my observation, but on finding, under a power of 1250 diameters, that the film was a felted mass of mycelium, bacteria, and micrococcus, I realized at once that the existence of such a lining of vegetable growth completely through the trap from its outer to its inner limit accounted for the penetration of disease germs through the best of these contrivances, and explained that frequent and deadly entrance of sewer infection through apparently tight traps which has been the despair of plumbers, sanitary engineers, and hygienists. Manifestly if the bacteria of putrefactive decomposition which make up this filthy coating, called *seilhaut* by the Germans, and probably in their growth give off the disgusting odor popularly known as "sewer gas," could thus intrude to the house side of the trap across the microscopic inequalities of the surface to which the ball "fitted air-tight," the micrococcus of diphtheria could likewise penetrate by the same occult but infallible pathway, and only chance had saved me and my family from similar access of typhoid fever or other pestilential germs. And it is further obvious that the various theories to account for sewer infection in spite of air-tight traps, such as the siphoning out of traps, their partial corrosion and leakage, the absorption of sewer gas by the fluid sealing them, and its evolution from the inner or house surface, etc., may be relinquished.

Fourth, as a remedy for offensive sewer emanations, solution of Sulphate of Iron (common Copperas) has long been known, and I am strongly inclined to hope that in it, when *properly and systematically applied*, we have an agent capable of making the surface of waste pipes unfit for vegetable growth or life, and so rendering these conduits completely sterile, just as certain weeds may be killed and conquered by watering the ground where they grow with a strong saline solution. American inventive genius

will probably supply a variety of contrivances for applying suitable parasitocides for this purpose as soon as any demand for them shall arise, but in the mean time I would suggest the use of the following simple apparatus which has proved quite successful in my own residence. Fit a half-gallon bottle with a tight, perforated cork carrying a glass tube about three-sixteenths of an inch in diameter; fill the bottle with solution of Copperas of the strength of one ounce to the pint of water, adapt the cork and invert the bottle over the basin (for example) of a stationary washstand, so that the fluid may slowly drip down the waste pipe. The apparatus may be conveniently supported on a board laid across the basin, and having near its centre a two-inch hole into which the neck of the inverted bottle is inserted. A pint or so of the same solution should first be poured down the holes of the overflow pipe, and the best time to use the contrivance is on going to bed, so as to leave the trap full over night of the mineral solution. Application in this way twice a week has so far seemed to answer the purpose in my house, but a still more effectual method would be to have a stop-cock placed in the waste pipe a foot or two below the trap, and every night or two closing this, fill the former and the adjacent portions of pipe with Copperas solution.

I believe we will only effectually combat these multitudinous disease germs, when we fully realize that they are each struggling to live and reproduce their kind, just as are the higher plants and animals throughout the whole course of Nature.

The fact that thistles and other noxious weeds so soon appear in neglected fields or gardens, shows beyond dispute how widely, and yet how imperceptibly, their seeds are disseminated, and how eager these seeds are to seize every chance for reproducing themselves after their kind, whenever and wherever suitable warmth, air, moisture, and nourishment happen to be afforded them. Even a little handful of earth in a rocky crevice is often forced to support some wandering nettle or poison-ivy, and its progeny of organisms hurtful to man, perhaps through a long series of generations.

In like manner, apparently, every diphtheritic spore and typhoid fever germ strives with all its puny might to live and grow and multiply itself, in the blind hope, as it were, that one of its in-

iquitous progeny will succeed in fastening upon some human being, whose affirmative power of constitution (as Emerson so aptly called the Life Force) is feebler than its own, and so accomplish its malevolent destiny. And whilst millions of such germs die for want of moisture, warmth, air and nitrogenous matter, and hundreds of millions flourish uselessly, because they cannot gain access to mankind, a few (relatively) out of these vast numbers steal past air-tight traps in the manner I have pointed out, and, establishing themselves on the inner side of such "safeguards," may be reproduced luxuriantly, and, under favorable circumstances, succeed in sending some of their descendants to inflict upon us the well-known disturbances of health which characterize the different contagious diseases.

Varied and prolonged courses of experimental inquiry will doubtless be requisite for deciding numerous minor details, and especially just how often waste-water pipes must be bathed with solutions of mineral substances, in order to secure the desiderata above indicated. But I am confident that the key to this momentous problem, of how to avoid infection from "sewer gas," or, more correctly, sewer air, entering our dwellings, is to be found in the principle of *so sterilizing* the whole interior of all pipes communicating with sewers, and, if possible, of the sewers themselves (by frequently irrigating them with fluids containing metallic compounds *poisonous* to plant life), that no vegetable organisms can propagate within them. Under such circumstances, *disease germs*, even if they penetrate for short distances through imperfect traps, will be powerless for evil, because a noxious element being introduced into their environment, the harmoniously favorable conditions necessary for their development and reproduction are disturbed.—*Medical News, Phila.*

Subsequent to the appearance of the above article by Professor Richardson in the *Medical News*, his attention was called to the merits of the GERMICIDE as meeting fully the requirements indicated by his conclusions, and of which he writes as follows:—

"I believe the key to this great problem is in having good ball or other mechanical traps to exclude *puffs* and *currents* of sewer air; and in sterilizing the inner sides at least of such traps, by some such method as you practice, enforcing, in fact, a genuine "Listerism" of our waste pipes and traps. Only thus can we escape the danger of house contamination, by the poisons of diphtheria, typhoid fever, etc., arising from sewers, and its terribly fatal effects upon human life."



THE GERMICIDE.

WHAT IT IS AND WHAT IT IS FOR

The GERMICIDE is an apparatus attached to Water-closets, which supplies a constant flow of a solution of Chloride of Zinc (Burnett's solution) through the closet and sewage, preventing decomposition; it also purifies the air of the room itself by giving off Thymol Vapor. Thus, offensive odors are destroyed and sewer gas is arrested in the traps.

It furnishes the antidote to the poisonous emanations from the sewer and drainage system, which, notwithstanding *the most perfect plumbing and ventilation*, enter the houses, causing diphtheria, malaria, and countless other diseases.

The GERMICIDE is a simple and neat contrivance made of Black Walnut which is easily attached to any *W. C.* without interfering with the Plumbing.

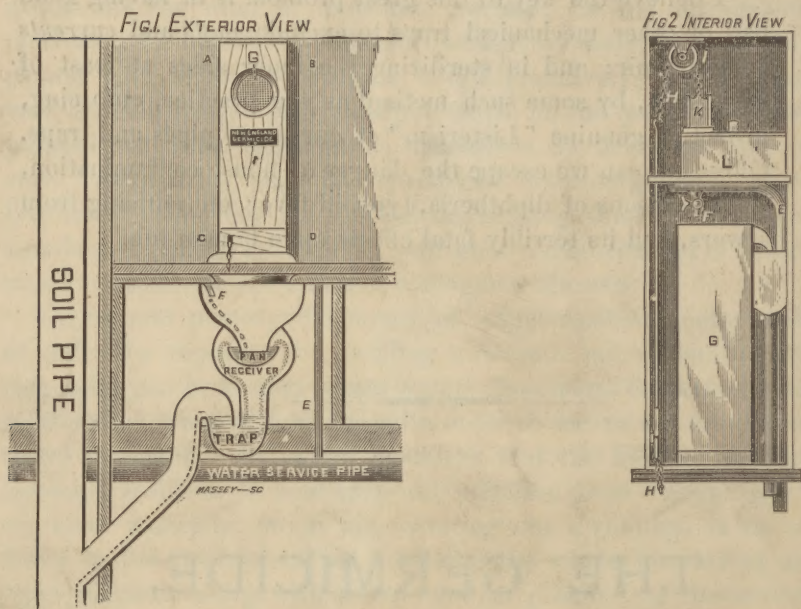


FIG. I.—*A, B, C, D*, represents the GERMICIDE as it appears behind the lid of the closet, being nearly concealed when the lid is raised. *E* is the pipe which carries water from the "water service pipe" into the appliance where the Chloride of Zinc is gradually dissolved and conducted into the basin, dropping from the pipe *F* as indicated by the dotted lines.

FIG. II. represents the interior of the GERMICIDE. The pipe *E* conducts water through the faucet *F* into the compartment *G*, which contains the Chloride of Zinc in solid form and from whence it escapes as a solution, dropping into the basin as indicated. The chain *H*, attached to the closet lid, passes over the pulley *I*, actuates the plunger *K*, causing it to enter the Thymol compartment *L*, whenever the closet lid is opened, and to be withdrawn whenever the lid is closed. The plunger, being clothed with an absorbent, becomes saturated with Thymol solution when lowered, and when raised liberates Thymol Vapor through the circular aperture *G*.

The GERMICIDE requires no attention whatever from the inmates of the house, as it is always under the supervision of the Company's uniformed, experienced inspectors. The appliance remains always the property of the Company, and is placed for service at such an annual rental for inspection and supply of chemicals as to bring it within the means of the most humble householder.